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Non Invasive Imaging (Echocardiography, Nuclear, PET, MR and CT)

THE INFLUENCE OF FRAME RATE ON TWO DIMENSIONAL SPECKLE STRAIN MEASUREMENTS: A STUDY ON SILICO SIMULATED MODELS AND IMAGES RECORDED IN PATIENTS

Poster Contributions
Poster Hall B1
Sunday, March 15, 2015, 9:45 a.m.-10:30 a.m.

Session Title: Non Invasive Imaging: Strain Imaging by Echocardiography
Abstract Category: 17. Non Invasive Imaging: Echo
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Background: Strain as a non-invasive myocardial deformation parameter has been shown to render valuable diagnostic and prognostic information. Settings during the acquisition process can have an important impact on the quality of the tracking. Frame rate (i.e. temporal resolution of the data set) seems to be of particular importance. The aim of this study was therefore to find the optimal range of frame rates needed for most accurate and reproducible 2D strain measurements using 2D speckle tracking software.

Methods: Synthetic two dimensional (2D) ultrasound grey scale images of the left ventricle (LV) were generated in which the endo-, myo- and epicardial strain in longitudinal, circumferential direction and radial strain were precisely known from the underlying kinematic LV model. Four models mimicking a normal, exercising, dilated and hypertrophied heart were generated at frame rates between 20 to 110Hz. These resulting images were repeatedly analyzed. Results of the synthetic data were validated in 66 patients, where long- and short axis views with acquisitions at different frame rates were analyzed with the same software.

Results: In simulated data accurate strain-estimates could be achieved at >30 frame per cycle (FpC) for longitudinal and circumferential strains. Lower FpC underestimated strain and SR systematically, while there was no effect on variabilities. Highest frame rates (> 95 FpC) had only slightly deteriorating effect on longitudinal strain variabilities and accuracies. Radial strain estimates were less accurate and less reproducible. Endo- myo- and epicardial strains were equally accurate. Patient strain displayed the same plateaus as in the synthetic models. Higher noise and the presence of artefacts in patient data was followed by higher data variability.

Conclusion: Standard machine settings with a FR of 35-60 Hz allow correct peak global longitudinal and circumferential strain in the majority of patients, while quantification of radial strain cannot be recommended for clinical use, yet. The influence of correct definition of the region of interest within the myocardium as well as the reduction of noise and artifacts seem to be of highest importance for accurate 2D strain estimation.